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ADDRESS OF THE RETIRING PRESIDENT

READ AT THE NEW YORK MEETING, DECEMBER 27, 1916

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It is now thirty years since this Society was founded and it may not be inappropriate to say something about its history and its prospects, to inquire whether its definitions are accurate and its methods such as best to yield the desired results.

Up to the present time there have been seventeen general conventions and at each one of them the retiring president has given advice to the Society. So much has been said that I hesitate to cover the same ground and yet I have a desire to express certain views in regard to our policy. These views are not original, for all of them have been expressed by some one or more members of our organization, but I believe that not all of them have been brought together at one time and urged as I hope to urge them upon your attention. What I have to say relates to the difficulties which are met in carrying out the policy of the Society in establishing new chapters and electing members. It would seem that in thirty years the policy of the Sigma Xi should have been fairly well settled—that we should know by this time in what type of institutions we ought to establish chapters, what class of young men or young women should be elected to membership, and what kind of meetings should be held. The place which this organization should hold in each college or university ought also to be very definitely determined. I fear, however, that all of our chapters do not agree upon any one of the above questions of policy. In some instances the differences are so marked that it would seem as though all the chapters could not be members of the same general organization.

During the last two years I have had occasion to give quite close study to the affairs of the Society and I feel very strongly in regard to some of the points which I have just named. This fraternity will always live because research work not only appeals to a certain type of mind but is absolutely essential for the growth of science and the development of individuals and nations. Mere existence, however, is not what we want. We wish to live an energetic, forceful life. We wish to have such a position in every institution of learning where science is taught and productive scholarship is

encouraged that every man who has the ability to do original work will not only desire membership but will feel great pride in the fact that he has been elected to the organization. We wish to have such a reputation that every member, although he was elected as an undergraduate and has never done any research work in his life, will feel proud to wear our emblem and will always speak of his election to the Sigma Xi as one of the greatest honors of his life. We wish to have such a standing in research that every institution which regards original work as a part of its legitimate duty will desire a chapter. If the Society is to have this standing we, its members, must thoroughly believe in it and must recognize the fact that membership is not bestowed for excellent scholarship alone but that it is a reward for research work or for the ability to do such work. I do not mean to insinuate that the men actually engaged in research work are not proud of their membership, but I do believe that we have not been aggressive enough in bringing our Society to the attention of the world at large or to alumni and students of our institutions. I would like to dwell upon several points which seem to me to need the attention of the Society.

RESEARCH

The motto of our organization is "Companions in Zealous Research." The object of the Society is said to be to encourage original investigation in science, pure and applied. We have never defined the word "research" and until we do define it we shall have no definite standard to judge the work of members or of applicants for a charter. The Century Dictionary defines research as "diligent inquiry, examination, or study; laborious or continued search after facts or principles; investigation." I suppose we usually mean by research, a study along scientific lines, the object of which is to discover facts or laws hitherto unknown, or to determine new methods of applying facts or laws already known. Research may take very many different forms; it may mean an investigation in pure science or applied science; it may have for its object the determination of things which will be useful to mankind; or it may search for facts or principles which the research worker may think will never be of use to anybody. Research may be in mathematics, or biology, or chemistry, or physics, or engineering, or mechanics, or botany, or medicine—in fact, there are as many different lines of research as there are sciences, and investigations in any of them,

the object of which is to discover something hitherto unknown, may be called research. In trying to determine the meaning of research as used in our Constitution we must keep in mind the distinction between research made in a college where the object is chiefly to delve into the unknown without making any commercial use of what is discovered; research which is carried on in great manufacturing establishments, the object of which is to find something which will improve practical methods of manufacture; and research carried on in colleges by properly trained scientific workers, who are really employed or paid by manufacturing or commercial organizations to try to determine something which they need in their business, the results of which will not be published but will be for the exclusive use of those who have met the expense. Which if any, of these definitions is the proper one for the term "research" as used in the Sigma Xi? It is perfectly evident that each one of these kinds of research has been in the minds of some of our number, for if we examine closely the reasons why our members have been elected we find that some have been chosen because they were workers in pure science; others because they have worked in applied science and applied science only; others because they have made discoveries of great value to the world while they have been in the employ of commercial organizations; and others who have worked in college laboratories for commercial organizations.

At the last meeting of the Executive Committee, in response to a request from one of the chapters, it was ruled, subject of course to correction by the convention, that in the election of faculty and nonresident members, emphasis should be laid in fact as it is in form upon the word "noteworthy" in the phrase "noteworthy achievement," and "original" in the phrase "as original investigator," and that routine construction or publication of routine work does not meet the spirit of the Constitution. So far as I am aware, this is the first attempt made by the Society to limit the word "research," and even this is not very clear.

If in the phrase "noteworthy achievement," "achievement" means "research," and "noteworthy" means standing above the ordinary achievement or research, then very few of our present membership would qualify for admission to the Society. In the phrase "original investigator" I would suppose that the term "original" meant something out of the common—unique, new—that is, an original investigator is one who investigates unknown things and finds some new

laws or facts. This definition is less severe than the former and is capable of wider interpretation. As a member of the Executive Committee I am partly responsible for this limitation, but I believe it should be regarded only as an attempt to define the quality of work which ought to lead to membership and not in any way as final or complete.

The Executive Committee has received many applications for charters and many more were received by the Council when that body was in existence. The balloting upon these applications has shown very great differences of opinion. In some instances a few of the members of the Council and some of the chapters have voted affirmatively, while in other cases more than half of the votes have been favorable but the necessary three-fourths have not been obtained. In only a very few instances have there been enough affirmative votes to permit the formation of a chapter. It is evident, then, that either the members of the Council and the chapters did not have sufficient information in regard to the institutions and the men applying or that different tests were being used. The difficulty must lie very largely with the definition of the term "research" which the different chapters are trying to apply. My first suggestion, then, as retiring president, is that this Society take steps to definitely define the term "research" so that the Executive Committee, in passing upon the applications of colleges for charters, and the chapters themselves, in passing upon the qualifications of candidates for membership, may have so clear a definition that they cannot by any possibility make a mistake. It should be definitely understood by the Society whether a new way of feeding chickens so as to fatten them sooner for market, or a variation of some method in the study of series, or the analysis of a few hitherto unknown specimens of ore, should under the definition, be called "research." Until a definition is adopted the chapters cannot use any common method for the election of members and each one may consider all of the others wrong in their interpretation of our constitution.

GRANTING OF CHARTERS

Nearly all organizations which have members in different parts of the country and which find it desirable to have frequent meetings establish branches or chapters or lodges in various cities or institutions. If they did not do so they could not expect to bring

to their members the advantages which it is desired that they should enjoy. Almost as soon as the parent chapter of the Sigma Xi was established at Cornell, some of the officers began to correspond with scientific men in other institutions to find out whether they had felt the need of a similar organization. It is known that societies of somewhat similar character were started in one or two institutions before the Sigma Xi was established, but they did not remain in existence for very many years. The movement for expansion on the part of the Cornell Chapter very soon resulted in establishing chapters at Rensselaer and Union in 1887 and at Kansas in 1890. Chapters were also established at Stevens and Rutgers but they went out of existence very soon after their foundation. These chapters were established by the Cornell Chapter because there had not been a general convention of the Society and hence there was no governing body to take the initiative. The first general convention was held in May, 1893. This convention practically adopted the constitution which had been in use at Cornell and added to it a section providing for the establishment of new chapters. Beginning in 1893 biennial conventions were held until 1906. An extra convention was held in 1907 and since that time there have been annual meetings. In all of these conventions the subject of new chapters has held a very prominent place. It has seemed desirable that every effort should be made to determine the character of the institutions from which petitions have been received and the ability of the men who have signed the petitions. It has not been considered desirable to make it easy for any institution to secure a charter. Petitioning institutions have been obliged to prove that they would follow out the principles of the Society and would carefully guard its membership.

Conventions of the Society have from time to time expressed their opinions in regard to the question of expansion and some of these expressions have been deemed so important that they have been printed as appendices to the Constitution and have come to be regarded as a part of it. Thus the Convention of 1895 stated, "The policy of the Society in the establishing of new chapters is a matter of vital importance to its future growth and standing. . . . It proposed to recognize and elect to its membership those men in our institutions of learning who should exhibit in a marked degree the qualifications of natural endowment and training required for successfully conducting original research in the various branches

of science. . . . Great care is necessary in establishing chapters, in order to insure the proper discrimination of men who are to go forth as representatives of the best results of scientific education in the United States. To attain these ends our policy should be eminently and sternly conservative, while at the same time we should be fully alert and sensitive to the needs of progress in science and education. . . . In order to make Sigma Xi an honor society it is essential that the men of first rank in the institution be given election. . . . We should make sure that we entrust the power of distributing the honor membership only to such persons and institutions as are capable of giving the education and training necessary to the carrying on of scientific investigation, and as have shown by their organization and equipment that they know the requisite qualifications, and are likely to confer the honor where it properly belongs."

This Convention also made certain recommendations in regard to the establishment of new chapters.

At the Convention of 1897 the president, in his presidential address said, "In order to win a permanent place for science, in that ideal education, it must be demonstrated that the study of science contributes a factor toward this ideal which is not and cannot be furnished by the literary branches. This quality we believe to be found in the ability and promise of original research. In extending this Society we should realize the importance of holding up this educational position of science for recognition and honor."

The Convention of 1911 recommended to the Council that at any petitioning institution there shall be a satisfactory and continuous output of research work.

These quotations show that from the beginning there has been a feeling at the conventions and thus supposedly in the chapters, that the Society should have a definite method with regard to the admission of chapters and that no institution should be admitted to membership unless it came up to a very high ideal of instruction and of research among the members of its faculty. It was not desired that chapters should be multiplied rapidly but it was considered far safer to take plenty of time to investigate the character of each application rather than to grant charters indiscriminately as is sometimes done by organizations having a different aim. That these efforts were successful is shown by studying the dates when

the several chapters were admitted. Thus in 1886 Cornell established the first chapter of Sigma Xi. The admission of new chapters has been as follows:

1887	Rensselaer and Union
1890	Kansas
1895	Yale
1896	Minnesota
1897	Nebraska
1898	Ohio State
1900	Pennsylvania, Brown, Iowa
1901	California
1902	Stanford
1903	Columbia, Chicago, Michigan, Illinois
1904	Case, Indiana
1905	Missouri, Colorado
1906	Northwestern, Syracuse
1907	Wisconsin, University of Washington
1908	Worcester
1909	Purdue
1910	Washington University
1915	Texas
1916	District of Columbia

The Society has been in existence thirty years and there are thirty chapters—thus we have on the average admitted one new chapter per year. The present Executive Committee is fully in sympathy with the ideals which have already been stated and has adopted the following statement in regard to the conditions which should prevail in any institution before a charter for a new chapter should be granted:

1. The authorities of the college or university, i. e., the trustees and the president, should be favorably disposed towards research.
2. There should be apparatus and facilities available for research.
3. The members of the faculty who sign the petition should be men who have had adequate training for research.
4. There should have been a continuous output of research from the institution for a number of years preceding the application for a charter.
5. There should be appropriations for research, or at least a certain amount of the appropriations made to the scientific departments should be available for apparatus for research.

Yet, notwithstanding all that has been done to prevent the admission of undesirable chapters and to keep out of the Society

those persons who are not imbued with the same high purposes in research as prevail among all of the present chapters, the methods which have been in use for determining whether charters should be granted or not have not been entirely satisfactory.

At the second Convention of the Society held in Springfield, Massachusetts, in 1895, a Council was established. The officers of the Society became ex-officio members and there was one representative elected by each chapter. The elected members were to be in office for five years and one of them was to be appointed chairman by the president of the Society. The Council was chiefly concerned with the establishment of new chapters. Before a charter could be given it must receive the affirmative vote of three-fourths of the Council and if successful in this it must then receive the affirmative vote of three-fourths of the chapters. The formation of this Council was undoubtedly a wise act, for it served as a balance-wheel to steady the growth of the Society. The institution which could run the gauntlet, first of the Council, and secondly, of the chapters, was pretty certain to have the qualifications which would make it an honor to the fraternity. But after a number of years this method was found to be too cumbersome. It was exceedingly difficult to get three-fourths of the Council to vote on any question. Several applications were not granted because the members of the Council would not vote upon them at all or else because there were not sufficient votes from the chapters. The result was that almost every application that was brought in was refused, only a few passing the ordeal. This is proved by a study of the number of chapters established in certain periods. Thus, during the first twelve years of the Society's existence eight chapters were established. During the next eight years seventeen chapters were organized, while during the last eight years only five chapters have been admitted. From 1910 to 1915 not a single chapter was organized. One chapter was organized in 1915 and an alumni chapter in 1916. Since 1910 only one collegiate chapter has been admitted.

Thirty chapters in thirty years is an admirable record and one of which we may all be proud, but no member of the Society would claim that we have established chapters in all the institutions which are worthy of such an honor. If there are difficulties in the way of founding chapters where they ought to be placed we should overcome those difficulties by some changes in our rules. The Society recognized the difficulties which have been mentioned and at the

Convention two years ago abolished the Council and provided in its stead an Executive Committee to consist of seven members. A part of the duties of the Council was given to the Annual Convention and a part of its duties to the Executive Committee. It will be remembered that one of the duties of the Executive Committee is to examine the petitions for charters and to make recommendations to the Convention. This method is a great improvement upon the old method because the committee of seven, which holds two or three meetings in the course of a year, can act definitely and at once upon an application. When petitions were referred to the Council a great deal of correspondence was necessary, because there was only one meeting a year and it was sometimes difficult to get a quorum. Under the present method it will be possible for the Executive Committee to make definite recommendations to the first convention which is held after an application has been received, unless in its opinion it would be well to withhold such recommendation until after further study. While this method gives some relief from the difficulties heretofore experienced it does not altogether provide a perfect method of procedure. The final decision still rests with the chapters themselves because it is by their vote at the Convention that new chapters are or are not established. I think the power to establish new chapters ought to lie in the Convention—that is to say, in the representatives of the different chapters, and yet this method has its disadvantages.

It is well known that many large organizations grant new sections or chapters through the action of small committees, whose business it is to pass upon the qualifications of applicants, and this has come about because it has been found almost impossible to get a large affirmative vote at conventions. I think it has been clearly proved by our experience in the past that applications for charters have in many cases been turned down because the convention representatives of certain chapters did not know anything about the state of research work in the petitioning institutions, and hence they voted in what seemed to them to be the safe way—that is to say, in the negative. For quite a number of years preceding the present date it has been practically impossible to secure favorable action in regard to the granting of new charters although many petitions have been received. In a number of instances many of the members of the Council or of the Executive Committee, who have visited the petitioning institutions, have been entirely satisfied that

chapters should be established, but this information has not been sufficient to convince the Convention of the wisdom of favorable action. Now it is manifestly impossible for the majority of chapters to know very much about what is going on in institutions which are distant from them, except through the Executive Committee or some other committee. As I have already said, it is desirable that the Convention, that is to say, the chapters, should vote upon each petition. I do feel, however, that the chapters should not definitely tie the hands of their representatives, but should give them freedom to exercise their best judgment after they have listened to all that is said in the Convention. I am also firmly of the opinion that the Convention should give great weight to the recommendations of its Executive Committee and that the Executive Committee should be expected to get perfectly definite information in regard to the petitioning institutions before it makes any recommendations. I would like to suggest that such recommendations be presented to the convention in writing and made a part of the minutes.

The Society of the Sigma Xi should have chapters in every institution which comes up to its standards of research. These chapters should be established because, if our organization means anything, it means that all who are interested in research and are giving themselves to it during a portion of their time should be united, through the Sigma Xi, for mutual encouragement and assistance. There is no reason why we should include research workers of one institution and leave out those who are doing equally good work in another institution. Every state university which is carrying on original investigations of value and which encourages research should have a chapter of our Society. I believe also that the smaller colleges, if they have the requisite number of departments doing original work, and if the right spirit exists in them, should also have chapters. We should encourage the few workers in a small college as much as the many workers in a large university. But there is another phase to this matter. If we do not ask these other institutions to join our membership, or if we do not give them encouragement when they send in petitions for charters, it is perfectly certain that other research fraternities will be established and will have chapters not only in those institutions where we are not represented, but will inevitably in the future have chapters in those institutions where we are represented. One such organization has been started during the past year in a western university for

research workers in agriculture. There has been a feeling on the part of some of our members that research in agriculture is not on a par with research in physics or chemistry, or biology, or mathematics. Agriculture is a combination of many sciences. Our farmers do not grow as large crops, our feeding does not produce as much beef, or milk, or pork, or eggs as it ought to. The agricultural problems which are of fundamental importance to every person in the nation are of importance to us, and we should recognize every new and valuable contribution which comes from the departments of agriculture in our state universities. It ought not to be necessary for agricultural workers to establish a research society of their own. We ought to welcome them to our membership.

I have already discussed the meaning of research and have recommended that an accurate definition of the word be adopted. It is evident that there is a very close connection between a definition of research and the establishment of new chapters. If the Executive Committee is to assume for itself a definition of research, it may be that at some time its ideas will be totally at variance with those of some of the chapters, but if a formal definition is established by the Society, then the Executive Committee will have something specific to go by. The Executive Committee, therefore, ought to be relieved from embarrassment and have its duties so clearly defined that it can do its work thoroughly and present its opinions definitely and clearly to the conventions.

Two applications presenting somewhat unusual circumstances have been brought before the Executive Committee during the past year. One was from two institutions jointly. These institutions are in the same city and the petition was signed by quite a number of men who are doing efficient and thorough work. The Executive Committee, however, held that it had no authority under the Constitution to recommend a charter to men of two institutions. The other application was from one department in a certain institution asking that a chapter be established with the understanding that only members of that single department would be eligible for membership. The Executive Committee replied that it did not understand it was authorized under the Constitution to recommend a charter to one department of an institution; that it would probably be very difficult if not impossible for that department to refrain from admitting to membership professors in other departments.

MEMBERSHIP

The founders of the Sigma Xi were, with one exception, engineering students of the senior class of Cornell University. Later Professor Williams joined them but was for a time the only faculty member. The Society, then, started with students, and was intended to be of benefit to them. Professor Williams was elected president of the Cornell Chapter in 1887, and delivered an address before the Society on June 15. This address holds up before the Society the highest ideals of scholarship and of attainment, but is evidently directed to students, for he speaks of making Sigma Xi an ideal for ambitious students, the attainment of it an honor to be coveted above all others, etc. Early in the history of the organization four more professors and a few graduate students were elected by the students to membership. Just when the control of the chapters passed out of the hands of the students and into the hands of the faculties I do not know, but the control did so pass and now in many of the chapters no students at all are elected to membership unless they are graduate students doing research work. In other chapters, students are admitted to membership on the day of graduation, while in still others, seniors may be elected at any time during the senior year. The great majority of students elected, whether in the senior year or during commencement week, do not become research students, and most of them probably pay very little attention to research after they graduate. This condition is unfortunate because when a member sees the badge worn by another member, he is not at all sure whether it has been given for research or for a promise which has never been fulfilled. I earnestly hope that the new class of membership inaugurated today will be adopted by all of the chapters and that hereafter no undergraduate student will ever be elected to active membership.

It is an anomalous condition when in any organization there are two or three standards for the election of members, and that there are in the Sigma Xi is very evident from the statement of the qualifications for membership as given in the Constitution. Before he can be eligible, a member of the faculty, according to our fundamental law, must show noteworthy achievement as an original investigator; a resident graduate must exhibit an aptitude in scientific investigation; an undergraduate in the fourth-year class must give promise of marked ability in those lines of work which it is the object of this

Society to promote. We have no one qualification for membership; a person's eligibility depends not alone upon what he has done but also upon his position in his institution. This state of affairs has been a process of growth and was not the original intention of the founders. It would be more consistent, perhaps, if there were two societies instead of one—one society being made up of members of faculties who are really research men and the other being made up of students who have given promise of ability in original work.

If we, as a society, are convinced that there should be this distinction between those who have done research work and those who have merely displayed an ability which may, under proper circumstances, enable them to do research, then it is possible, under the amendment to the Constitution which has this day been adopted, to accomplish the same result, for we can limit active membership to accomplishment and associate membership to promise among either undergraduate or graduate students. Will not this be the most satisfactory solution of this question? If different badges are adopted for the two classes, some confusion which now exists will be done away with. Whenever we see the badge of the Society upon any person we shall know that he has done research work which has been considered valuable by other research workers, and the pin for the associate members will indicate at once that the person has given promise of research but has not yet accomplished it.

Every productive worker in science, no matter to what institution he belongs, should be elected to membership in the Sigma Xi by the chapter in his own institution if one exists; if there is no such chapter he should be elected by a chapter in some other institution. One of the objects of our society is "to encourage original investigation in science, pure and applied, by establishing fraternal relations among investigators in scientific circles." Would it not be desirable to insert the word "all," making it read "to encourage original investigation in science, pure and applied, by establishing fraternal relations among *all* investigators in scientific circles." Should not all workers in science, who are dissatisfied with the present condition of knowledge and are adding to it by their own investigations—those who have felt the lure of the unknown and are striving to make it the known—be brought together in this great organization to which we belong? While raising a high standard of admission and living up to it with absolute rigidity,

we ought to be careful not to pass by any of those who really belong among our number, simply because they are not connected with our institutions or because they have not graduated from institutions in which we have chapters. The Society of the Sigma Xi is a brotherhood of some of those doing research work. Let us make it a universal brotherhood of all who are engaged in the same kind of labor and whom we can aid or who can aid us.